

In the Specification:

On page 1, after the title insert the following:

RELATED APPLICATIONS

This is a U.S. national stage of application No. PCT/DE2003/002727, filed on 13 August 2003.

This patent application claims the priority of German patent application no. 102 37 119.9 filed 13 August 2002, the disclosure content of which is hereby incorporated by reference.

FIELD OF THE INVENTION

Page 1, before line 9, insert the following heading:

BACKGROUND OF THE INVENTION

Page 2, before line 21, insert the following heading:

SUMMARY OF THE INVENTION

Page 2, amend the paragraph beginning on line 21 follows:

~~It is therefore an~~ One object of the invention is to ~~specify~~ provide a display apparatus which has a touch-sensitive layer and which nevertheless has protection against surface reflections from ambient light.

Page 2, delete the paragraph beginning on line 26 through page 3, line 2 in its entirety and insert the following paragraphs:

This and other objects are attained in accordance with one aspect of the present invention directed to a display apparatus having a display layer and a touch-sensitive layer running parallel thereto. The side of the touch-sensitive layer which is remote from the display layer has an antireflection lattice comprising lattice elements which can move toward one another.

Another aspect of the present invention is directed to a display apparatus having a display layer and a touch-sensitive layer running parallel thereto. That surface of the touch-sensitive layer which is remote from the display layer has a lattice-like surface texturing, the lattice spacing being matched to the pixel spacing on the display layer such that the ratio of the lattice spacing to the pixel spacing is whole-numbered.

Page 3, amend the paragraph beginning on line 4 as follows:

The ~~even~~ whole-numbered ratio of the lattice spacing to the pixel spacing ensures that the light emitted by pixels on the display layer is not scattered, but rather reaches the observer directly. The lattice forms more or less microscopic channels. Obliquely incident light, on the other hand, is reflected or absorbed by the lattice elements.

Page 3, delete the paragraph beginning on line 12 in its entirety.

On page 3, before line 20, insert the following paragraph:

Yet another aspect of the present invention is directed to a display apparatus having a display layer and a touch-sensitive layer running parallel thereto. The touch-sensitive layer contains lattice elements, the lattice spacing being matched to the pixel spacing on the display layer such that the ratio of the lattice spacing to the pixel spacing is whole-numbered.

On page 3, amend the paragraph beginning on line 20 as follows:

In the case of such an embodiment, the lattice elements which prevent reflections have already been integrated into the touch-sensitive layer. ~~A fourth way of achieving the object is for the touch-sensitive layer in a display apparatus of the type mentioned at the outset to be formed by strip-like lattice elements arranged in lattice form, and for touch sensors to be integrated into the nodes of the lattice.~~

Still another aspect of the present invention is directed to a display apparatus comprising a display layer and a touch-sensitive layer running parallel thereto, wherein the touch-sensitive layer comprises strip-like lattice elements arranged in lattice form, and touch sensors integrated into nodes of the lattice. In such an embodiment, the touch-sensitive components and the antireflection components ~~are~~ need not be separate units, but rather the same elements can perform functions both for avoiding reflections and for producing the touch sensitivity.

On page 4, delete the paragraph beginning on line 34 in its entirety.

On page 4, before line 37, insert the following heading:

BRIEF DESCRIPTION OF THE DRAWINGS

On page 5, before line 29, insert the following heading:

DETAILED DESCRIPTION OF THE DRAWINGS

On page 5, amend the paragraph beginning on line 37 through page 6, line 15 as follows:

Figure 2 shows the display apparatus from figure 1 in a more detailed illustration. As can be seen from figure 2, the antireflection lattice 4 comprises a multiplicity of lattice elements 5. These are at a predetermined angle 9 on a touch-sensitive layer 3. Preferably, the angle 9 is 90°. The lattice elements 5 form microscopic channels 10 through which an observer looks onto the touch-sensitive layer and onto the display layer 2 underneath. The display layer includes an array of pixels 8. In order for good visibility to be ensured, the lattice elements 5 are thus oriented parallel to the viewing direction 12. Incident light 18 from the side is absorbed by the lattice elements 5 and as a result only a small proportion thereof reaches the at least partially reflective surface of the touch-sensitive layer 3 or of the display layer 2.

On page 6, amend the paragraph beginning on line 17 as follows:

Particularly in the case of small portable appliances such as the PDAs shown in figure 1, it is easy to hold the appliance respectively such that the viewing direction is at right angles to the display apparatus 1. In the case of larger appliances such as

Notebooks or permanently installed flat screens, however, it is not always possible or not always easy to orient the display apparatus 1 with respect to the user in optimum fashion. It is therefore advantageous if the lattice elements 5 are not rigid but rather are able to move such that their angle 9 with respect to the touch-sensitive layer 3 can be altered. This can be achieved, for example, by the use of strip-like lattice elements 5 with slots at the lattice nodes 13, such that the strip-like lattice elements 5 running in one direction of the lattice are not connected to the strip-like lattice elements 5 running orthogonal to them. In the case of an embodiment with an adjustable angle for the lattice elements, optimum orientation can be achieved by means of user setting or automatically on the basis of the incident ambient light. To this end, by way of example, a sensor may be provided which measures the angle of incidence of ambient light and uses appropriate control apparatuses to actuate the lattice elements 5 such that they are at an optimum angle.

On page 7, amend the paragraph beginning on line 1 as follows:

The lattice elements 5 are either partially transparent or nontransparent. To attain a satisfactory action, the material of the lattice elements 5 should be light-absorbent or should form a light-absorbent surface. The lattice elements 5 could, for example, be made of some conductive polymer material, which can be printed directly on the surface of the touch-sensitive layer 3.

On page 7, amend the paragraph beginning on line 6 as follows:

For the quality of the display apparatus 1, it is necessary for the lattice spacing between lattice elements 5 to be matched to the pixel spacing of the pixel elements 8 on the display layer 2. Otherwise, the "Moiré effect" may arise. This occurs when ~~odd~~ fractional-numbered spacing ratios mean that lattice elements 5 are situated above pixel elements 8 in particular regions, while in other regions the lattice elements 5 are situated precisely between two pixels. The Moiré effect can be avoided if the ratio of lattice spacing to pixel spacing is ~~even~~ whole-numbered. In figure 2, the lattice spacing has been chosen such that it is twice the size of the pixel spacing. Two pixels 8 therefore have one lattice element 5.

On page 7, amend the paragraph beginning on line 21 as follows:

Figure 3 shows a three-dimensional schematic illustration of the arrangement of the lattice elements 5. ~~The lattice nodes 13 are each in a form such that slots in the strip-like lattice elements 5~~ at lattice nodes 13 ensure that the lattice elements are flexible with respect to one another. This is important so that pressure on the lattice elements 5 is respectively transferred to the underlying location on the touch-sensitive layer 3.

On page 7, amend the paragraph beginning on line 30 as follows:

Figures 4 to 6 show alternative configurations of the antireflection lattice 4. In the illustration in figure 4, studs are provided at the lattice nodes 13. This stud-like configuration ensures a very beneficial transfer of force to the touch-sensitive layer 3. If the studs are of an appropriate size and the lattice spacing is correspondingly small, an adequate antireflection action can be produced. For example, the height of the studs can be comparable to the lattice spacing.

On page 9, delete the paragraph beginning on line 29 through page 10 line 4 in its entirety.

On page 10, delete the paragraph beginning on line 6 in its entirety and insert the following:

Figure 10 shows an embodiment of a display apparatus based on the invention in which lattice structures have been incorporated into the touch-sensitive layer 3, for example through etching a grid structure into the touch-sensitive layer or doping the material used for the touch-sensitive layer 3. In this case, the lattice elements do not need to be flexible. The lattice elements may also be formed from liquid crystals or an electrochromic material contained in the touch-sensitive layer 3. In this case, the lattice elements can be turned on or off as required by applying an electrical field in the area of forming the lattice elements, e.g., by applying a conductive surface coating acting as electrodes on each side of the touch-sensitive layer 3 and applying an electrical charge to these electrodes. The applied electrical field results in a change of the optical properties of

the electrochromic material, for example by changing from a transparent to an absorbing state. So as not to impede the display properties of the display layer, the lattice spacing should also be matched to the pixel spacing in this case.

When liquid crystal antireflection lattices are used, the optical orientation of the lattice elements can be adjusted by changing the orientation of the electrical field used to activate the liquid crystals, for example through rearranging the electrodes used to generate this field. In this case, the adjustment can be made either manually by the user or automatically on the basis of the level and/or angle of incident ambient light.

The scope of protection of the invention is not limited to the examples given hereinabove. The invention is embodied in each novel characteristic and each combination of characteristics, which includes every combination of any features which are stated in the claims, even if this combination of features is not explicitly stated in the claims.

Delete page 11, in its entirety.